HASTINGS VACUUM GAUGE

MODEL DNNV-46J

# INSTRUCTION MANUAL

TELEDYNE
HASTINGS-RAYDIST

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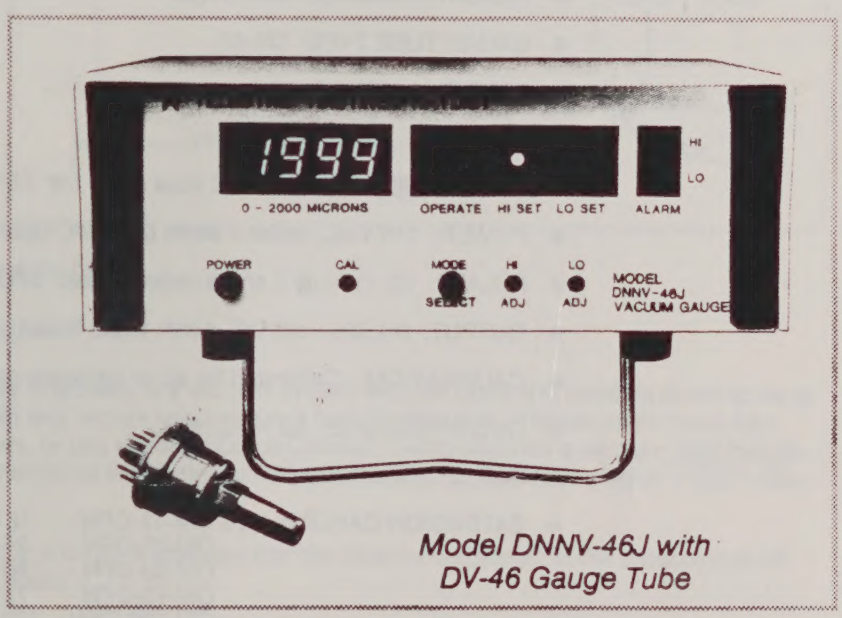
# 1.0 GENERAL INFORMATION

## *1.1 Features:*

The Hastings Digital Thermopile Vacuum Gauge, Model DNNV-46J, is a combination of modern technology and the proven Hastings thermopile, resulting in a linear digital vacuum gauge for the range of 1-1999 microns Hg. The instrument incorporates an analog signal to drive a remote indicator used for recording, data logging, etc. The output is scaled so the voltage units equal the pressure units, simplifying calibration of add-on equipment. 1 millivolt equals 1 micron. Dual alarm set points are displayed on the digital meter in pressure units by depressing the mode switch, and are set from the front by the adjustment of trim pots.

Relay action is displayed on the front panel by LED's which light when the relay is energized. Relays provide a common - normally open and normally closed contacts rated at 5 amps 115 VAC.



*Model DNNV-46J with DV-46 Gauge Tube*

DV-46 gauge tubes are interchangable without requiring recalibration. They use a new dual element thermopile (pat. pending) which optimizes sensitivity over a wider range of pressures. This permits electronic linearization without a loss of accuracy and tracking prevalent in other single element systems.

Relay and output connections are standard terminal strip connections located on the rear of the instrument.

The power cord and gauge tube cable are also attached to the back panel. Up to 100-foot gauge cable extensions are available.

## *1.2 Warranty:*

Teledyne Hastings-Raydist warrants this product, for a period of one year from date of shipment, to be free from defects in material and workmanship, and to perform to published specifications.

This warranty does not apply to defects or failures resulting from unauthorized modification, misuse or mishandling of the product. This warranty also does not apply to fuses, filters, batteries, or other expendable parts, nor to damage caused by leaking batteries, clogged filters, or similar occurrences.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty as to fitness for a particular use. Teledyne Hastings-Raydist shall not be liable for any indirect or consequential damages.

Refer to Service Section 6.0, for information on obtaining warranty or other service for this product.

## 1.3 Operating Principle:

The operation of Hastings Vacuum Gauges uses a patented noble metal thermopile circuit. The hot junctions of the thermopile are heated directly by an a-c current while an equal number of cold junctions are kept at ambient temperature by heavy mounting studs. Thus a d-c voltage is generated between hot and cold junctions. As the pressure decreases, the lowering of the thermal conductivity of the gas surrounding the hot junctions tends to increase the temperature of the hot junctions, thus increasing the output of the thermopile. This change in output is amplified, linearized, and calibrated as a function of pressure and is displayed on the meter.

## 1.4 Specifications:

- INDICATOR MODEL: DNNV-46J
- GAUGE TUBE TYPE: DV-46
- RANGE: 1-1999 microns
- READOUT: Digital LED display
- GAUGE TUBE: Nickel plated steel shell, 1/8" NPT male connection
- POWER: 115 VAC, under 5 watts (230 VAC optional)
- RELAYS: (2) 115V @ 5 amps resistive load, SPDT
- OUTPUT: 0-1.999 volts DC, 4 mA. max., linear
- CALIBRATION: Calibrated for air or nitrogen; consult factory for other gases
- OVERPRESSURE: 50 PSIG max.
- CABLE: 8 ft. attached
- EXTENSION CABLES: type OM-12-OFN - 12 ft.
  OM-25-OFN - 25 ft.
  OM-50-OFN - 50 ft.
  OM-75-OFN - 75 ft.
  OM-100-OFN - 100 ft.

A special factory calibration is necessary for extension cables.

## 2.0 INSTALLATION PROCEDURE

### 2.1 Panel Mounting:

The DNNV-46J electronic package can be panel mounted in an 8.250" X 3.000" cut-out with four corner screw holes as shown in Figure 1. When installing the DNNV-46J, first insert the unit through the panel cut-out, and then insert a mounting screw through each corner hole to a washer and nut behind the panel.

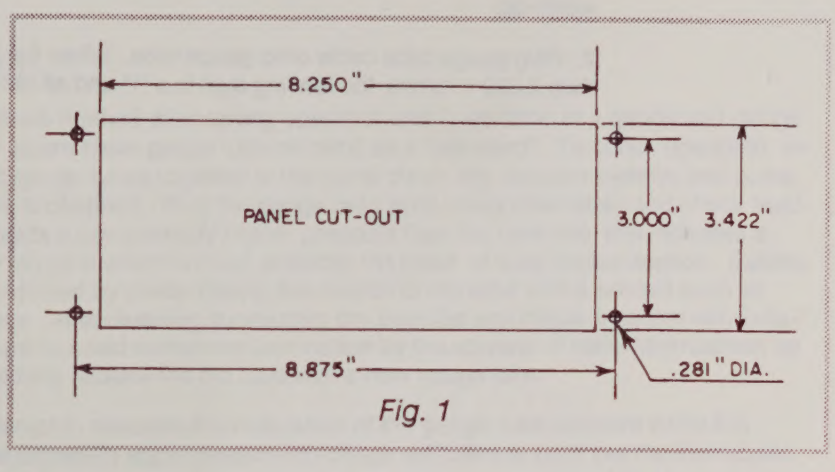


Fig. 1

### 2.2 Gauge Tube Installation

Situate the gauge tube in a clean, dry vacuum system with the open end pointing down so as to be self-draining should any vapors condense in it (see Section 5.0). Thread metal tubes into 1/8" female IPS threads, or use Hastings Quick Connect O-ring seals for a vacuum tight installation. For more information on installation accessories, refer to Specification Sheet #352 in Section 7.0.

For maximum accuracy, it is recommended that the tube be outgassed in the vacuum system for approximately 24 hours.

## 3.0 OPERATION OF VACUUM GAUGE

1. Plug the 8 ft. power cable into any single phase 115 VAC (DNNV-46J) or 230 VAC (EDNNV-46J) line. Either 50 or 60 Hz is satisfactory line frequency. Allow several minutes for warm-up.

2. Plug gauge tube cable onto gauge tube. When the tube is exposed to pressures greater than 2,000 microns, the leading digit is a "1" and all remaining digits are blanked.

# 4.0 CALIBRATION AND TROUBLESHOOTING GUIDE

All Hastings Vacuum Gauges and Tubes have been carefully checked and calibrated at the factory before shipment. If a calibration check is desired, the methods in the following Sections may prove helpful.

## *4.1 Check of Tube Accuracy:*

The simplest and quickest method of checking operation and calibration of a gauge and gauge tube is to keep a new spare clean gauge tube on hand as a "standard". To check operation, install both new and old gauge tubes together in the same clean, dry vacuum system, and pump until a steady pressure is obtained. Plug the gauge onto both tubes alternately and check readings. If the old tube reads a considerably *higher* pressure than the new one, this indicates a calibration shift in the old tube which is most probably the result of tube contamination. Calibration can possibly be restored by *gently* rinsing the interior of the tube with a solvent such as freon or trichlorethylene. After cleaning, thoroughly dry the tube and degas it before reinstallation in a vacuum system to avoid system contamination by the solvent. If calibration cannot be restored by this procedure, replace the old tube with a new gauge tube.

*CAUTION: Do not attempt to measure the resistance of the gauge tube element while it is under vacuum. Some ohmeters apply measuring voltage sufficient to burn out the thermopile while under vacuum. The resistance of the gauge tube can be measured safely at atmospheric pressure. This measurement is made between pins 2, 3, 5, and 6 counting clockwise from the key located on the base of the gauge tube. A measuring device such as the Triplett Model 630 Test Set, with the ohms switch on the "X10" range, is suitable for this purpose.*

## *4.2 DNNV-46J Calibration Check:*

All calibration voltages are factory set and will rarely change. The methods for checking gauge calibration are detailed below:

4.2.1 Zero and Full Scale Check

1. Turn power on and allow several minutes warm-up time. Connect a gauge tube to the instrument. When the DV-46 gauge tube is exposed to atmospheric pressure the analog output of the DNNV-46J should be 2.000 VDC (see Calibration Note below).

2. Install the gauge tube into a vacuum system as described in Section 2.2. Pump the tube down to a hard vacuum pressure (i.e. $\leq$0.1 micron). Check this pressure against a reliabale reference such as the McLeod Gauge. The DNNV-46J analog output should be 0.000 VDC $\pm$4mv when the tube is exposed to hard vacuum.

*CALIBRATION NOTE: In some cases, such as drastic component changes or repairs, a calibration shift may occur. Calibration shifts which cannot be corrected with the CAL pot indicate probable shifts at either the zero or full scale point.*

3. To make a full scale calibration check, set a system pressure of 1100 microns using a reliable reference gauge. The DNNV-46J can now be set to 1100 microns by adjusting the CAL pot. This should facilitate optimum tracking throughout the entire range of the instrument.

## 5.0 NOTES ON VACUUM MEASUREMENT

### *5.1 Effects of Condensable Vapors:*

McLeod Gauges do not give correct readings if condensable vapors such as water, alcohol, acetone, etc., are present in the gauge. The McLeod Gauge operates by compressing the residual gases and vapors in obtaining a reading, and this compression will tend to condense any vapors that are present. This usually results in the McLeod Gauge reading a pressure that is too low. Hastings Thermopile Vacuum Gauges respond to the total pressure of all gases and vapors that are present in the gauge tube.

A trap cooled by liquid nitrogen is effective in removing vapors, but even so it may be necessary to keep the McLeod Gauge constantly under vacuum for several hours, or days, with a trap before it will read correctly. Reference should be made to the instructions furnished by the manufacturer of the McLeod Gauge to be sure that it is provided with a suitable trap.

### *5.2 Outgassing:*

Hastings Gauge Tubes are made of materials that have been proven by years of usage to be relatively free from outgassing. However, all surfaces of glass and metal that are exposed to the vacuum system may liberate gases and vapors that were previously absorbed during exposure to the atmosphere. If the surfaces are contaminated with foreign matter, this outgassing may be much more persistant than if the surfaces are clean. The possibility of outgassing must be considered in checking the accuracy of Hastings Gauges or in checking for leaks. This is especially important when working with pressures of less than 10 microns of mercury. In this range of pressures, outgassing from surfaces in a newly evacuated system may flood the enclosure. Also, if the system is being pumped continuously, gauges spaced at different distances from the pump wil register different pressures. For reliable comparison of different vacuum gauges, it is necessary then to insure that the vacuum system be free of any outgassing or other sources of apparent leaks. This can best be determined by closing the system off from the pumps and observing if there is any rise in pressure within the range of interest.

### *5.3 Ingassing:*

Ingassing is an effect opposite to outgassing, and can also lead to erroneous readings. Ionization gauges exhibit a kind of pumping action that tends to clean up residual gases in certain ranges of pressure and thereby lower the pressure. Also, if a cold trap is in a closed system, the total pressure may change considerably while condensable vapors such as water, carbon dioxide, and mercury are being condensed.

### *5.4 Effect of Thermal Conductivity:*

All Hastings Vacuum Gauges are originally calibrated in dry air. Since this calibration is a function of thermal conductivity, any gas having a thermal conductivity different from that of air will also have a different calibration. Contact factory for calibration in gases other than air.

### *5.5 Effect of System Conductance:*

Each element that makes up a vacuum system has associated with it a certain conductance (this is the opposite of resistance). For example, baffles, connecting tubing, and sharp turns can all cause pressure drops throughout the system during pumping and during the time the system is reaching static equilibrium. It is not an uncommon occurrence to measure different pressures at different locations in a vacuum system. In checking the calibration of any vacuum gauge, care must be taken to insure that the gauge and the reference are at the same pressure.

*PLEASE NOTE: DNNV-46J instruments are calibrated with the desired gauge tube cable extensions. A decal on the DNNV-46J rear panel indicates the cable extension present during calibration. No decal indicates the instrument was calibrated without any cable extensions. Customers who wish to change the gauge tube cable length must return the DNNV-46J to the factory for recalibration with the desired cable extension.*

# 6.0 SERVICE INFORMATION

## *6.1 Warranty Repair Policy:*

Teledyne Hastings-Raydist will repair or replace, at their option, any product covered under the warranty expressed in Section 1.2, that is returned transportation prepaid to their plant in Hampton, VA. All products returned must be accompanied by the Service Request information form on page 9 of this manual or a written description of the problem. Please contact factory for a Repair Authorization Number before returning any product for repair.

## *6.2 Non-Warranty Repair Policy:*

Any product returned for non-warranty repair must be accompanied with a purchase order authorizing repair up to 1/3 the list cost of a new product or $50, whichever is greater, and the Service Request information form on page 9 of this manual, or a written description of the problem. If the repair cost is higher, you will be contacted for authorization before we proceed. If you then choose not to have the product repaired, the $50 minimum will be charged to cover processing and inspection. Please contact factory for a Repair Authorization Number before returning any product for repair.


| | |
|---|---|
| TELEDYNE HASTINGS-RAYDIST | Telephone (804) 723-6531 |
| 804 NEWCOMBE AVENUE | FAX (804) 723-3925 |
| HAMPTON, VIRGINIA 23669 | TWX (710) 882-0085 |
| ATTENTION: REPAIR DEPARTMENT | EASYLINK: 62300280 |

*6.3 Service Form:*

TELEDYNE HASTINGS RAYDIST
804 NEWCOMBE AVENUE
HAMPTON, VA 23669 U.S.A.
TELEPHONE (804) 723-6531

RMA # _____
(contact factory )

MODEL NO._____ SERIAL NO._____ P.O. NO._____DATE_____

NAME_____PHONE_____

COMPANY_____

ADDRESS_____

CITY_____STATE_____ZIP_____

DESCRIBE PROBLEM:

_____

_____

_____

_____

SHOW A BLOCK DIAGRAM OF YOUR SYSTEM:

CALIBRATION RANGE_____ GAS_____ CABLE LENGTH_____

POWER LINE VOLTAGE_____ VARIATION_____

AMBIENT TEMPERATURE_____ GAS TEMPERATURE_____

OTHER_____

(IF SPECIAL MODIFICATIONS HAVE BEEN MADE BY USER, PLEASE DESCRIBE)

## 7.0 DIAGRAMS, DRAWINGS & SPECIFICATION SHEETS

This section contains the schematics, parts list, overall assembly drawings, and Specification Sheets for vacuum options and accessories. If replacement components are desired, they can be obtained from the factory by referencing the Hastings part number listed on the parts list.

NOTES:

1. INTERPRET DRAWING USING MIL-STD-100.
2. PART SYMBOLS ARE FOR IDENTIFICATION ONLY AND DO NOT APPEAR ON PART.
3. BRACKET ASSEMBLY IS TO BE ATTACHED WHEN BOARD IS ASSEMBLIED IN CASE.
4. CAPS TO SWITCH 1 & TO SWITCH 3 ARE TO BE ATTACHED AFTER BOARD IS ASSEMBLIED IN CASE, INSTALLED ON FINAL ASSY.
5. INSTALL I1, I2 SOCKETS FOR IC17 & IC18.
6. CMOS COMPONENT REQUIRES SPECIAL ANTI-STATIC PROTECTION DURING HANDLING, FABRICATION & TESTING.
7. INSTALL 12 SPLIT POST TERMINALS (2 FOR R1 & 10 FOR TP1 THROUGH TP10) ON COMPONENT SIDE PRIOR TO INSTALLATION OF OTHER PARTS.
8. IC17 & IC18 (56-01-112) MUST BE PROGRAMMED FOR HI BYTE (IC17) AND LO BYTE (IC18) BY PRODUCTION ENGINEERING.
9. FOR REPAIRS TO PC-750A CONCERNING IC-6 MC1469R REFER TO DWG 30041.

| REV | DESCRIPTION | DATE | APPROVED |
|---|---|---|---|
| D | REVISED ALL SHTS PER CAR #00262. | 9-30-87 GLS | |
| | RENUMBERED-WAS 5581950302 | 12-18-87 | |
| A | NEW ISSUE | 6/21/86 | C & K |
| B | CHANGE TO P/L PER CAR #00092 SHEET 1 ONLY. | 8/23/86 | C & K |
| C | RENUMBERED DWG., WAS 2468350302 | 9/9/86 | C & K |

| QTY REQD | ITEM NO | PART OR IDENTIFYING NO | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION |
|---|---|---|---|---|
| 1 | | IC20 | INTEGRATED CIRCUIT 741 OP AMP | 56-02-014 |
| 1 | | IC19 | DAC1220 | 56-01-113 |
| 2 | | IC17,IC18 | MM2716 | 56-01-112 |
| 1 | | IC16 | TSC8704 | 56-01-107 |
| 1 | | IC15 | CD4066 | 56-01-080 |
| 1 | | IC14 | CD4066874C04 | 56-01-051 |
| 1 | | IC13 | MC1741 | 56-02-042 |
| 2 | | IC9,IC12 | OP-07 | 56-02-027A |
| 4 | | IC11 IC7,IC8,IC10, | ICL7650 | 56-02-048 |
| 1 | | IC5 | INTEGRATED CIRCUIT AD580 | 13-01-147 |
| 6 | | D2 thru D7 | DIODE 1N2071 | 36-01-031 |
| 1 | | D1 | DIODE, SURGE SUPPRESSOR 250V | 13-01-077 |
| 1 | | C37 | CAPACITOR 68pf | 11-08-080 |
| 1 | B | C36 | CAPACITOR 270pf | 11-08-127 |
| 13 | | C20,C26,C28,C32,C33,C38,C39,C40,C42,C43 C15,C16,C19, | CAPACITOR 1µf 50V | 11-01-160 |
| 16 | | C14,C17,C18,C21,C22,C24,C25,C26,C27,C30,C31,C34,C36 C11,C12,C13, | CAPACITOR 10µf 20V | 11-03-150 |
| 2 | | C9,C10 | CAPACITOR 22µf 15V | 11-03-118A |
| 1 | D | C23 | CAPACITOR .001µf 1KV | 11-01-043 |
| | D | | | |
| 4 | | C3,C4,C5,C6 | CAPACITOR 1µf 35V | 11-03-111A |
| 2 | | C1,C2 | CAPACITOR 470µf 25V | 11-03-151 |
| 1 | | 30375 | PRINTED CIRCUIT BOARD, PC-750 | 26-04-750 |
| 1 | | | PRINTED CIRCUIT BOARD PC-750 ASSY | — |

PARTS LIST

| | |
|---|---|
| NEXT ASSY | 55-195 |
| APPLICATION | USED ON |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS ± DECIMALS .XX ± .XXX ± ANGLES ±

MATERIAL: SEE PARTS LIST

FINISH: —

DO NOT SCALE DRAWING

SYMBOL NO. 65-302

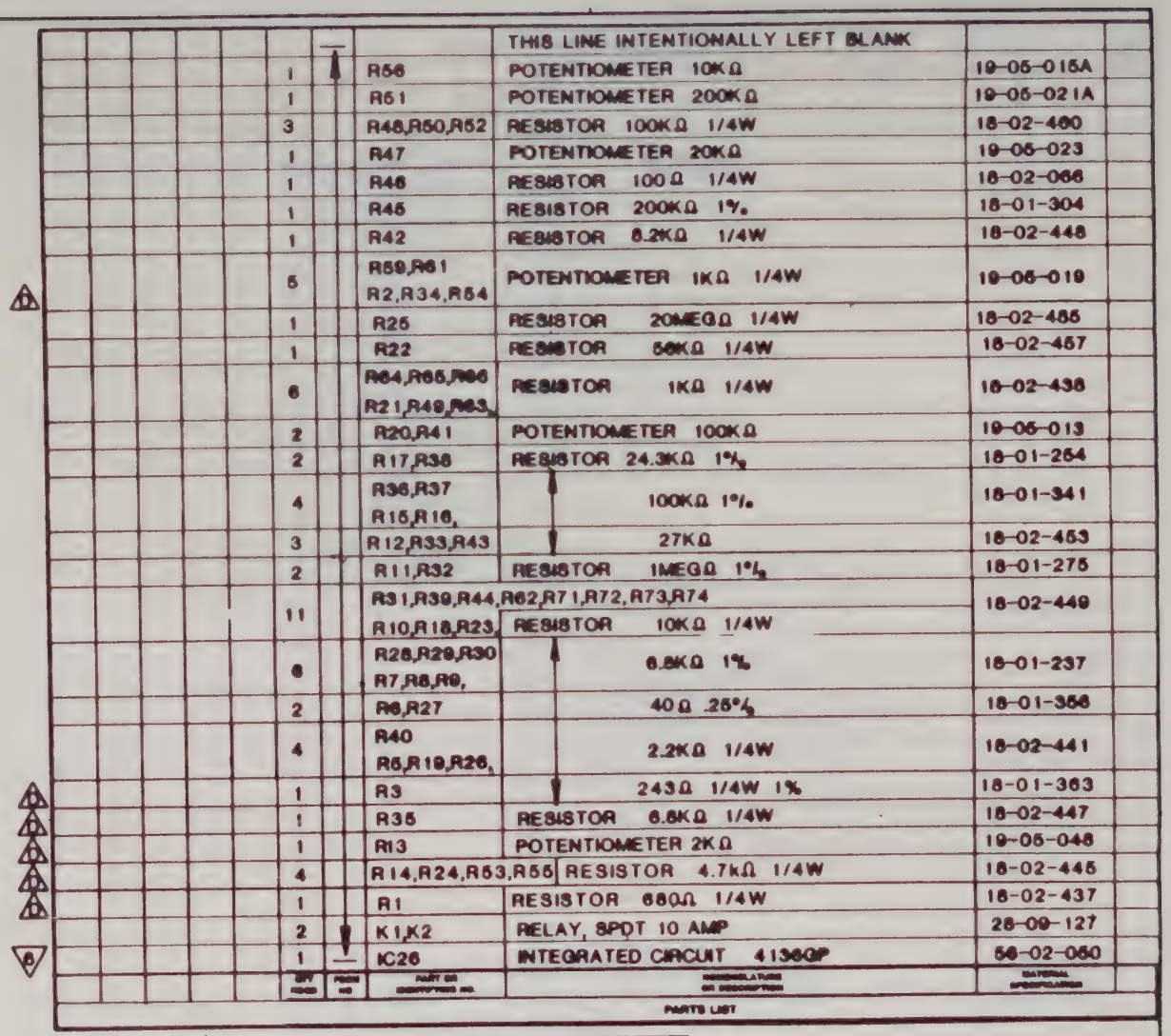
| APPROVALS | DATE |
|---|---|
| DRAWN P.M.MOSELEY | 4/3/86 |
| ENGINEER C.G.RIGGS | |
| ISSUED | |

TELEDYNE HASTINGS-RAYDIST
HAMPTON, VIRGINIA U.S.A.

# ASSY, MAIN BOARD PC-750 DNINV-46J VACUUM METER

SIZE B | FSCM NO. — | DWG. NO. 30376 | REV. D

SCALE NONE | SHEET 1 of 7



| QTY | FIND NO | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION |
|---|---|---|---|---|
| | | | THIS LINE INTENTIONALLY LEFT BLANK | |
| 1 | | R56 | POTENTIOMETER 10KΩ | 19-05-015A |
| 1 | | R51 | POTENTIOMETER 200KΩ | 19-05-021A |
| 3 | | R48,R50,R52 | RESISTOR 100KΩ 1/4W | 18-02-460 |
| 1 | | R47 | POTENTIOMETER 20KΩ | 19-05-023 |
| 1 | | R46 | RESISTOR 100Ω 1/4W | 18-02-066 |
| 1 | | R45 | RESISTOR 200KΩ 1% | 18-01-304 |
| 1 | | R42 | RESISTOR 8.2KΩ 1/4W | 18-02-448 |
| 5 | | R59,R61 R2,R34,R54 | POTENTIOMETER 1KΩ 1/4W | 19-05-019 |
| 1 | | R25 | RESISTOR 20MEGΩ 1/4W | 18-02-455 |
| 1 | | R22 | RESISTOR 56KΩ 1/4W | 18-02-457 |
| 6 | | R64,R65,R66 R21,R49,R63, | RESISTOR 1KΩ 1/4W | 18-02-438 |
| 2 | | R20,R41 | POTENTIOMETER 100KΩ | 19-05-013 |
| 2 | | R17,R38 | RESISTOR 24.3KΩ 1% | 18-01-264 |
| 4 | | R36,R37 R15,R16, | 100KΩ 1% | 18-01-341 |
| 3 | | R12,R33,R43 | 27KΩ | 18-02-453 |
| 2 | | R11,R32 | RESISTOR 1MEGΩ 1% | 18-01-275 |
| 11 | | R31,R39,R44,R62,R71,R72,R73,R74 R10,R18,R23, | RESISTOR 10KΩ 1/4W | 18-02-449 |
| 6 | | R28,R29,R30 R7,R8,R9, | 6.8KΩ 1% | 18-01-237 |
| 2 | | R6,R27 | 40Ω .25% | 18-01-356 |
| 4 | | R40 R5,R19,R26, | 2.2KΩ 1/4W | 18-02-441 |
| 1 | | R3 | 243Ω 1/4W 1% | 18-01-363 |
| 1 | | R35 | RESISTOR 6.8KΩ 1/4W | 18-02-447 |
| 1 | | R13 | POTENTIOMETER 2KΩ | 19-05-048 |
| 4 | | R14,R24,R53,R55 | RESISTOR 4.7kΩ 1/4W | 18-02-445 |
| 1 | | R1 | RESISTOR 680Ω 1/4W | 18-02-437 |
| 2 | | K1,K2 | RELAY, SPDT 10 AMP | 28-09-127 |
| 1 | | IC26 | INTEGRATED CIRCUIT 4136DP | 56-02-050 |

PARTS LIST

TELEDYNE HASTINGS-RAYDIST
HAMPTON VIRGINIA U.S.A.

DRAWN P.M.M. 4/03/86
ISSUED

SIZE B | FSCM NO. | DWG. NO. 30376 | REV D

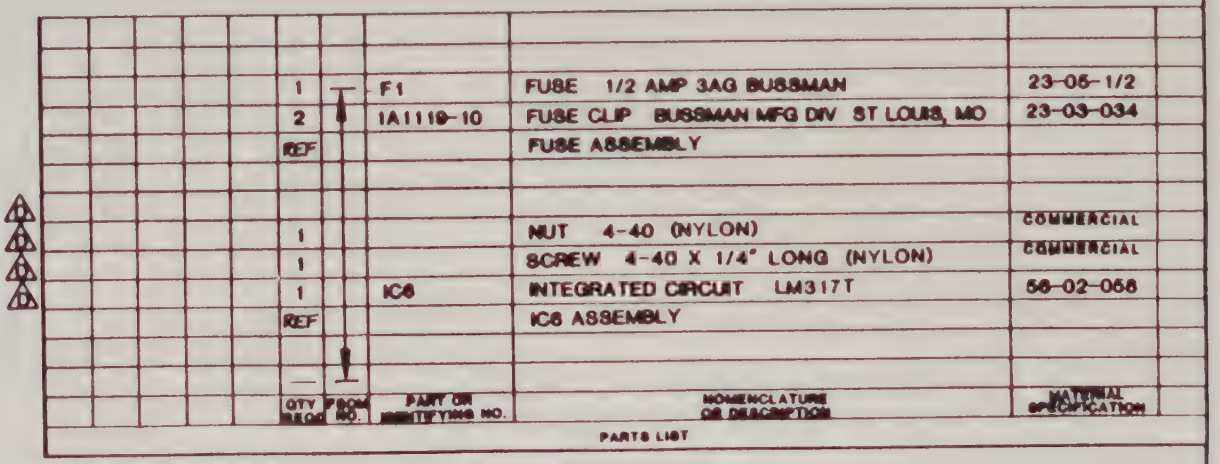
SCALE NONE | SHEET 2

| | QTY | PART ON IDENTIFICATION NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION |
|---|---|---|---|---|
| | 2 | | NUT, 4-40 | COMMERCIAL NYLON |
| | 2 | | SCREW, 4-40 X 3/8" LG. B.H. | COMMERCIAL NYLON |
| | 2 | | INSULATOR, MICA | |
| | 1 | 30381 | HEATSINK | |
| | 1 | IC4 | INTEGRATED CIRCUIT MC7905 | 56-02-047 |
| | 1 | IC2 | INTEGRATED CIRCUIT MC7912 | 56-02-046 |
| | REF | | IC2 & IC4 ASSEMBLY | —— |
| | 2 | | NUT 4-40 | COMMERCIAL NYLON |
| | 2 | | SCREW 4-40 X 3/8" LONG BINDER HEAD | COMMERCIAL NYLON |
| | 1 | 30381 | HEATSINK | |
| | 1 | IC3 | INTEGRATED CIRCUIT MC7805 | 56-02-020 |
| | 1 | IC1 | INTEGRATED CIRCUIT MC7812 | 56-02-021 |
| | REF | | IC1 & IC3 ASSEMBLY | —— |
| | REF | 30381 | BRACKET FOR T1 | |
| | REF | | SWITCH CAPS FOR S1 & S3 | 20-08-055 |
| | 2 | I1,I2 | SOCKET 24 PIN FOR IC17 & IC18 | 28-07-177 |
| | 3 | JA,JB,JC | FLEX STRIP 3" 8 CONNECTIONS EACH | 15-31-003 |
| 7 | 12 | R1 TP1 thru TP10, | SPLIT POST | 28-10-102 |
| | 1 | DBC | CONNECTOR, 12 PIN (CUT FROM 20 PIN) | 16-20-046 |
| | 4 | Q4,Q5,Q6,Q7 | TRANSISTOR 2N3906 | 51-06-006 |
| 6 | 2 | Q2,Q3 | TRANSISTOR 2N3904 | 51-06-006 |
| | 1 | T2 | TRANSFORMER HA11069 | 28-06-166D |
| | 1 | T1 | TRANSFORMER DPC24-450 | 12-01-136 |
| | 1 | S3 | SWITCH, SPDT P.C. MOUNT | 20-06-053 |
| | 1 | S2 | SWITCH, SLIDE 115/230 DPDT P.C. MOUNT | 20-03-049 |
| | 1 | S1 | SWITCH PUSH-ON P.C. MOUNT | 20-06-054 |
| | 2 | R68,R70 | RESISTOR 820KΩ | 18-02-468 |
| | 2 | R67,R69 | RESISTOR 4.7MEGΩ 1/4W | 18-02-481 |
| | 2 | R58,R60 | RESISTOR 220Ω 1/4W | 18-02-418 |

PARTS LIST

TELEDYNE HASTINGS-RAYDIST
HAMPTON VIRGINIA U.S.A.

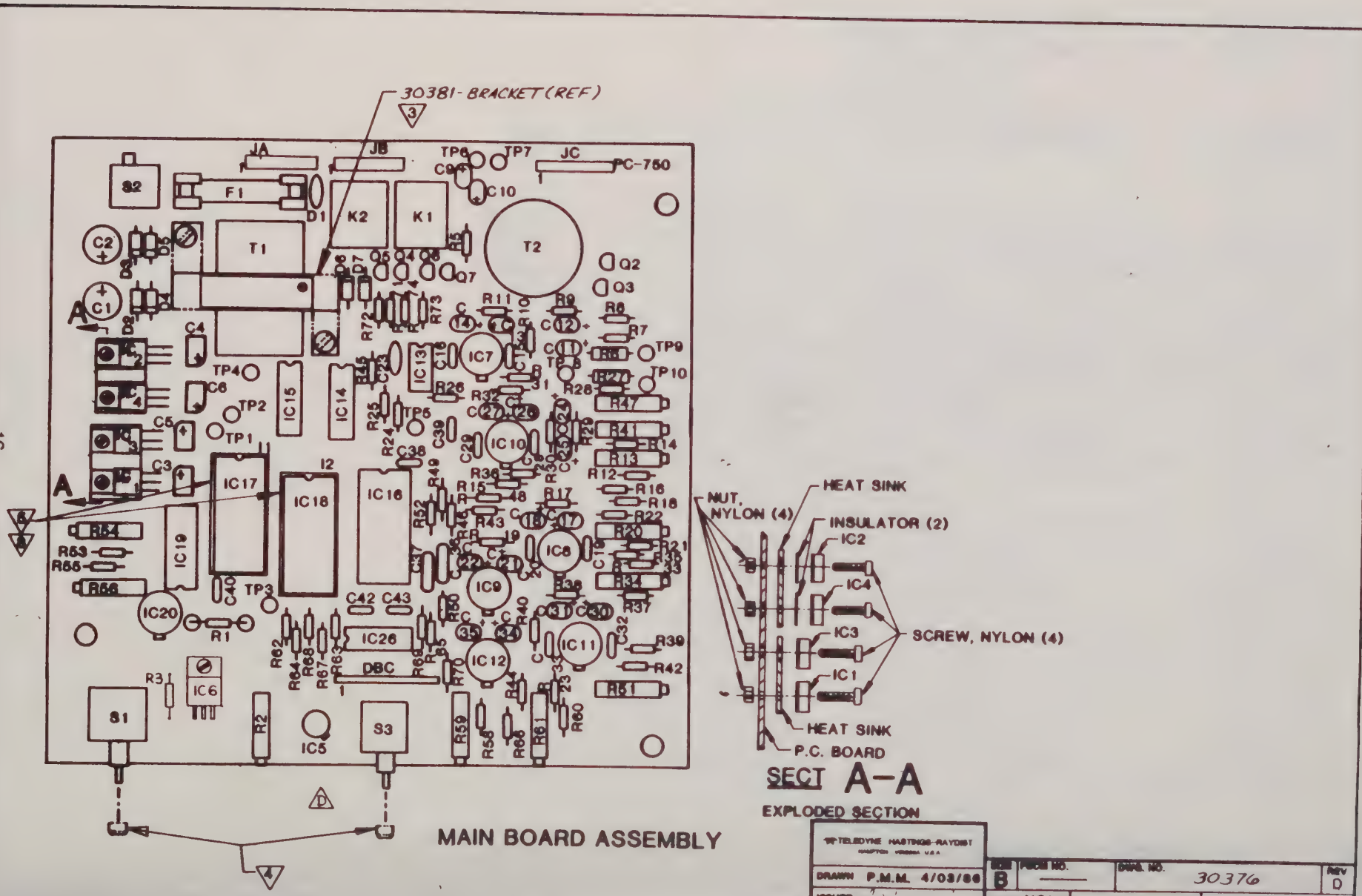
| | | | | |
|---|---|---|---|---|
| DRAWN P.M.M. 4/03/86 | SIZE B | FSCM NO. —— | DWG. NO. 30376 | REV. D |
| ISSUED | SCALE NONE | | SHEET 3 | |

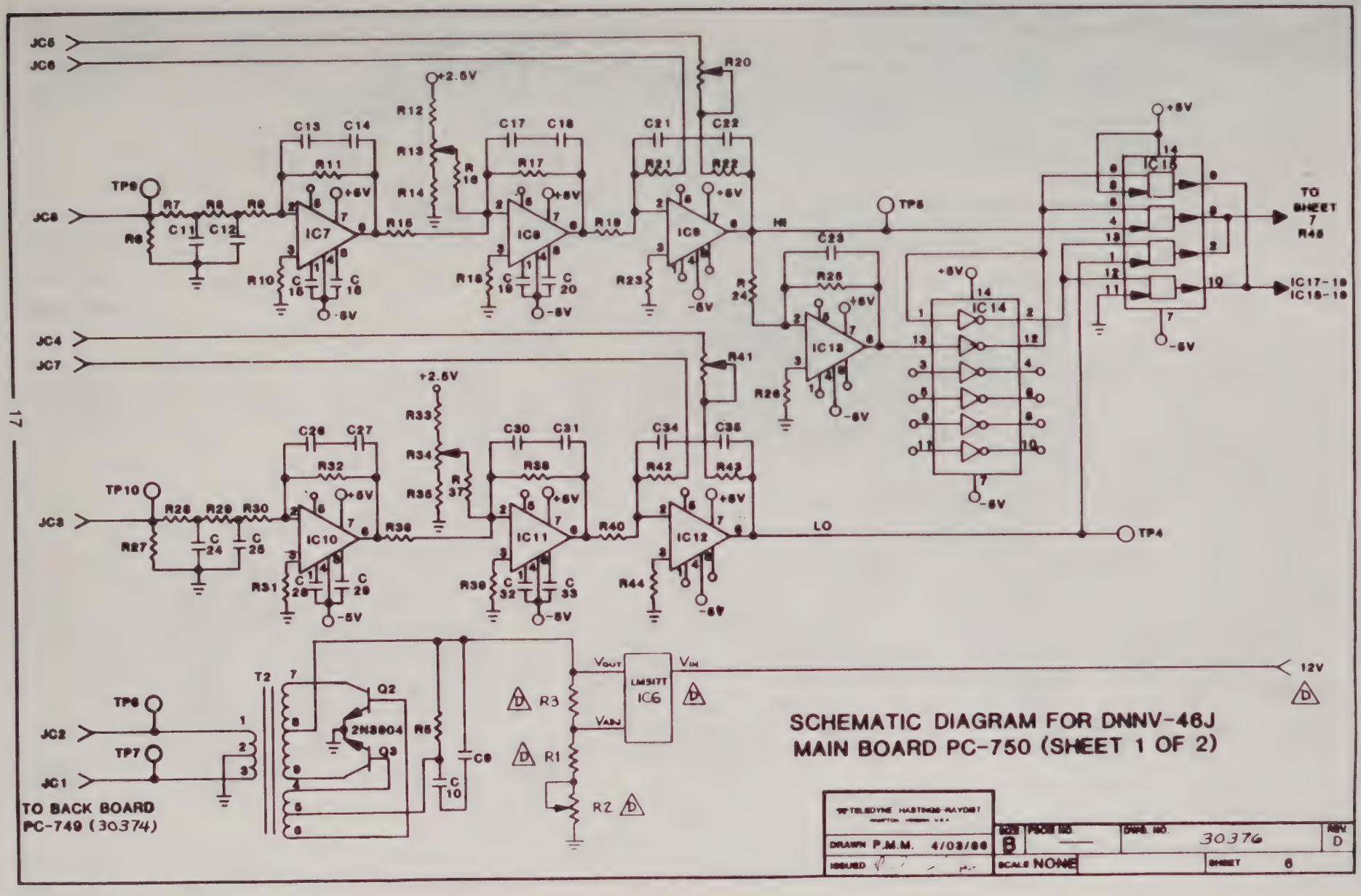


| QTY REQD | FIGM NO. | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION |
|---|---|---|---|---|
| 1 | | F1 | FUSE 1/2 AMP 3AG BUSSMAN | 23-05-1/2 |
| 2 | | 1A1119-10 | FUSE CLIP BUSSMAN MFG DIV ST LOUIS, MO | 23-03-034 |
| REF | | | FUSE ASSEMBLY | |
| | | | | |
| 1 | | | NUT 4-40 (NYLON) | COMMERCIAL |
| 1 | | | SCREW 4-40 X 1/4" LONG (NYLON) | COMMERCIAL |
| 1 | | IC6 | INTEGRATED CIRCUIT LM317T | 56-02-056 |
| REF | | | IC6 ASSEMBLY | |
| | | | | |
| | | | | |

PARTS LIST

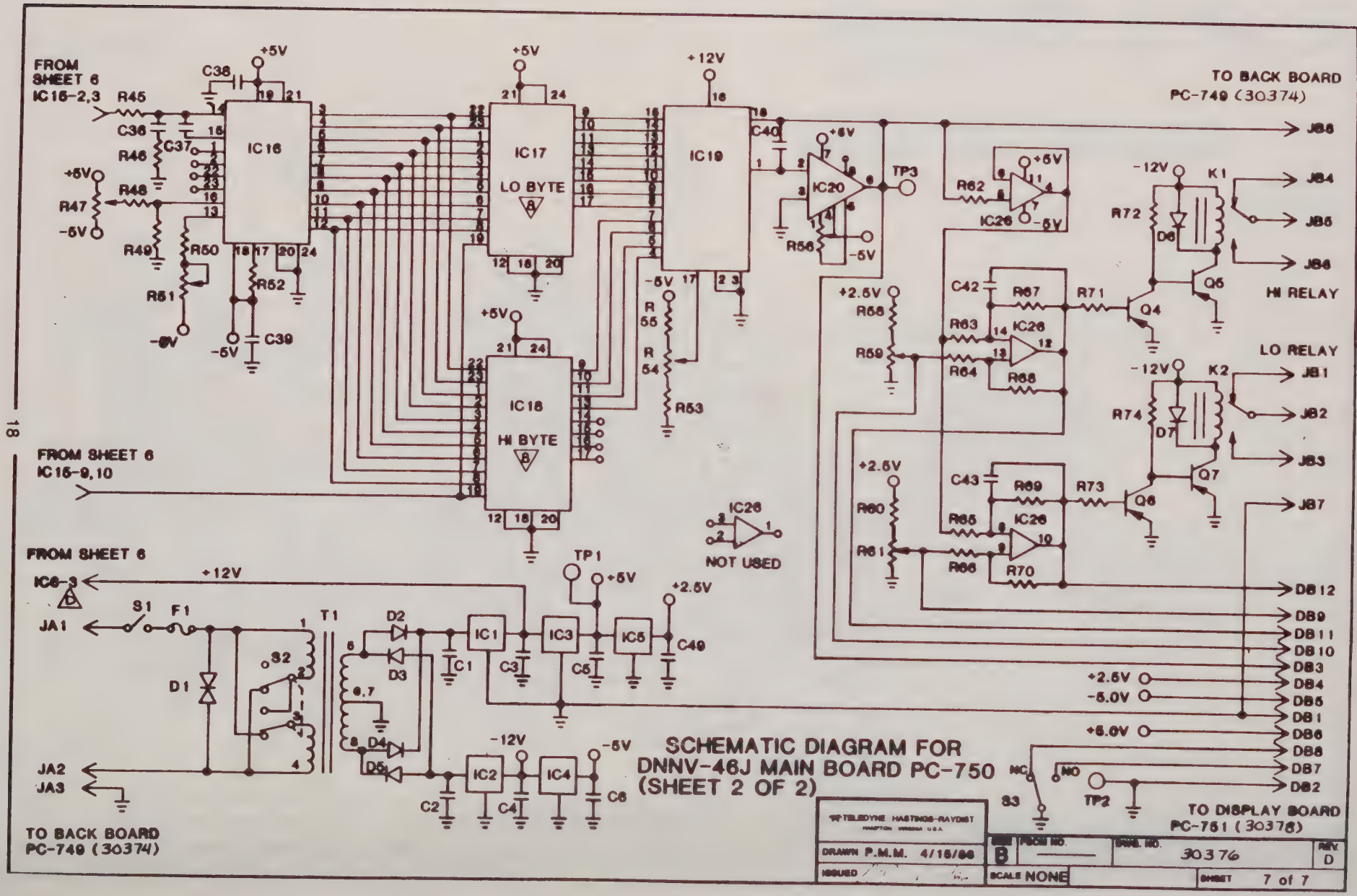
| | | | |
|---|---|---|---|
| TELEDYNE HASTINGS-RAYDIST HAMPTON, VIRGINIA U.S.A. | | | |
| DRAWN P.M.M. 4/03/98 | SIZE B | FIGM NO. | DWG NO. 30376 REV D |
| ISSUED | SCALE NONE | | SHEET 4 |


30381-BRACKET (REF)
3
JA
JB
JC
TP6
TP7
PC-750
S2
F1
D1
K2
K1
T1
T2
C2
C1
A
C4
C6
C5
C3
TP4
TP2
TP1
TP3
IC15
IC14
IC17
IC18
IC16
I2
IC19
IC20
R1
R3
IC6
S1
R2
IC5
S3
DBC
IC26
IC13
IC7
IC10
IC8
IC9
IC12
IC11
Q2
Q3
Q7
R6
R7
R9
R11
R47
R41
R13
R12
R16
R18
R22
R20
R34
R37
R39
R42
R51
TP9
TP10
R64
R63
R65
R66
R62
R68
R67
R63
R59
R58
R61
R60
6
5
4
NUT, NYLON (4)
HEAT SINK
INSULATOR (2)
IC2
IC4
IC3
IC1
SCREW, NYLON (4)
HEAT SINK
P.C. BOARD
SECT A-A
EXPLODED SECTION
MAIN BOARD ASSEMBLY
TELEDYNE HASTINGS-RAYDIST
DRAWN P.M.M. 4/03/86
ISSUED
SIZE B
FSCM NO.
DWG. NO. 30376
REV D
SCALE NONE
SHEET 5




SCHEMATIC DIAGRAM FOR DNNV-46J
MAIN BOARD PC-750 (SHEET 1 OF 2)

| | | | | |
|---|---|---|---|---|
| TELEDYNE HASTINGS-RAYDIST | | | | |
| DRAWN P.M.M. 4/03/86 | SIZE B | PROM NO. — | DWG. NO. 30376 | REV. D |
| ISSUED | SCALE NONE | | SHEET 6 | |


FROM SHEET 6 IC15-2,3
FROM SHEET 6 IC15-9,10
FROM SHEET 6 IC6-3
TO BACK BOARD PC-749 (30374)
TO BACK BOARD PC-749 (30374)
TO DISPLAY BOARD PC-751 (30378)
IC16
IC17 LO BYTE
IC18 HI BYTE
IC19
IC20
IC26
NOT USED
HI RELAY
LO RELAY
SCHEMATIC DIAGRAM FOR DNNV-46J MAIN BOARD PC-750 (SHEET 2 OF 2)
TELEDYNE HASTINGS-RAYDIST
DRAWN P.M.M. 4/18/86
ISSUED
SIZE B
DWG. NO. 30376
REV. D
SCALE NONE
SHEET 7 of 7

SEE SHEET 2 FOR NOTES.

| REVISIONS | | | |
|---|---|---|---|
| REV | DESCRIPTION | DATE | APPROVED |
| A | NEW ISSUE | 6-21-86 | C & R |
| B | DWG. RENUMBERED FROM 2468350303 w/ CHG.<br>B1 SHEET 2 REVISED PER CAR #00104 | 9/9/86 G.L.S. | C.G.R 9/10/86 |
| C | QTY OF FLEX STRIPS FOR DB WAS 1. ADDED NOTE 5. PER CAR #00211. | 8/19/87 PMM | |
| D | REVISED PER ECN # 019 | 1/7/88 | |
| X | RENUMBERED - WAS 5581950303 | 12-15-88 | |

| QTY | QTY REQD | ITEM NO | PART OR IDENTIFYING NO | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION |
|---|---|---|---|---|---|
| 4 | 4 | | R88<br>R57, R80, R87 | RESISTOR 100KΩ | 18-02-460 |
| 1 | 1 | | 30377 | PRINTED CIRCUIT BOARD, PC-751A | 26-04-751A |
| 1 | 1 | | IC28 | INTEGRATED CIRCUIT ICL7107CPL | 56-01-140 |
| 1 | 1 | | IC27 | MC75492P | 56-01-110 |
| 1 | 1 | | IC25 | CD4066 | 56-01-080 |
| 1 | 1 | | IC23 | N74193 | 56-01-066 |
| 2 | 2 | | IC22, IC24 | MM74C00N | 56-01-049 |
| 1 | 1 | | IC21 | INTEGRATED CIRCUIT MC14538BCP | 56-01-086 |
| 2 | 2 | | D13, D14 | DISPLAY PANASONIC | 13-06-048 |
| 6 | 6 | | D8 THRU D12 | DIODE RED LED | 13-01-135 |
| 1 | 1 | | C48 | CAPACITOR .1µf 200V | 11-09-026 |
| 1 | 1 | | C47 | .047µf 200V | 11-09-031 |
| 1 | 1 | | C46 | .01µf 50V | 11-01-162 |
| 1 | 1 | | C45 | .1µf 50V | 11-01-159 |
| 1 | 1 | | C44 | 100pf | 11-06-001 |
| 3 | 3 | | C41, C49, C50 | CAPACITOR 1µf 50V | 11-01-160 |
| 1 | 1 | | | PRINTED CIRCUIT BOARD PC-751A ASSY | |

PARTS LIST

| | |
|---|---|
| | |
| | 55-195 |
| NEXT ASSY | USED ON |
| APPLICATION | |

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE: FRACTIONS ± .XX ± .XXX ± DECIMALS ± ANGLES ±

MATERIAL: SEE PARTS LIST

FINISH: ———

DO NOT SCALE DRAWING

SYMBOL NO. 65-303

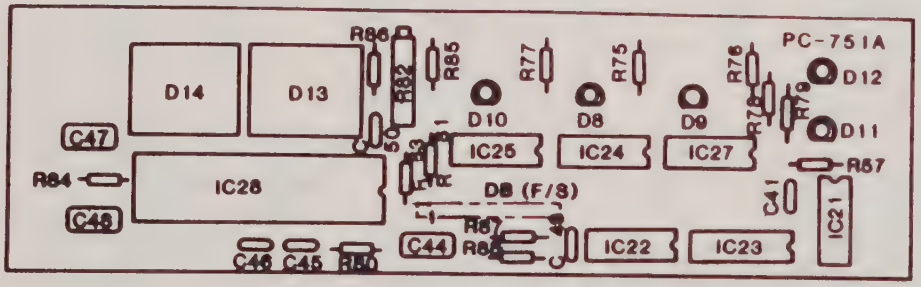
| APPROVALS | DATE |
|---|---|
| DRAWN P.M.MOSELEY | 4/3/86 |
| CHECKED C G RIGGS | 5/29/86 |
| ISSUED | |

TELEDYNE HASTINGS-RAYDIST
HAMPTON, VIRGINIA U.S.A.

ASSY, DISPLAY BOARD, PC-751A
DNNV-46J VACUUM METER

| SIZE | FSCM NO | DWG. NO. | REV |
|---|---|---|---|
| B | ——— | 30378 | D |

SCALE NONE | SHEET 1 of 3




## DISPLAY BOARD ASSEMBLY

NOTES:

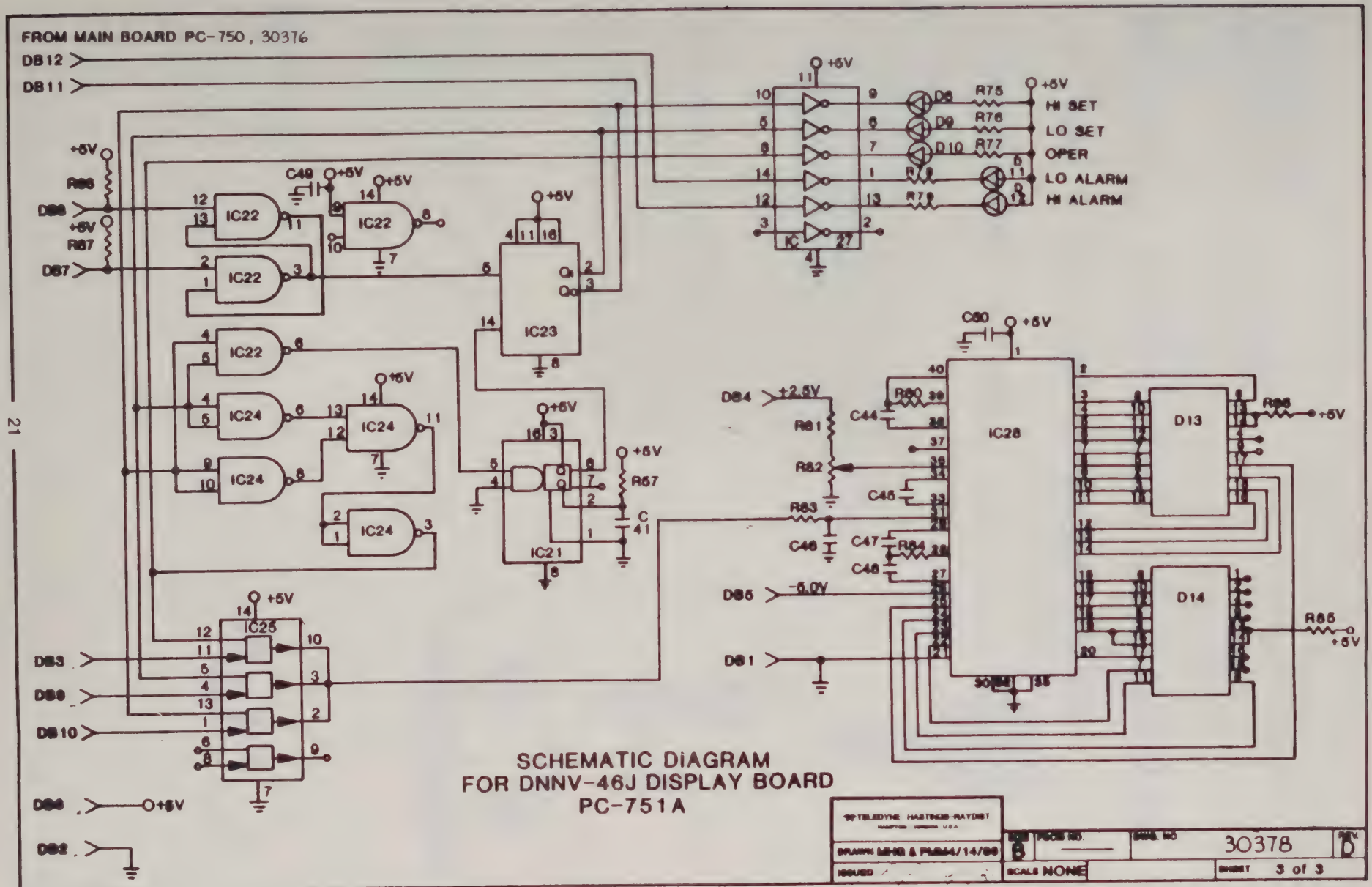
1. INTERPRET DRAWING PER MIL-STD-100.
2. PART SYMBOLS ARE FOR IDENTIFICATION ONLY AND DO NOT APPEAR ON PART.
3. CMOS COMPONENT REQUIRES SPECIAL ANTI-STATIC PROTECTION DURING HANDLING, FABRICATION & TESTING.
4. FLEX STRIP IS INSTALLED FROM CIRCUIT SIDE OF BOARD.
5. EACH FLEX STRIP HAS 8 CONNECTIONS. TO MAKE "D8" (WHICH HAS 12 CONNECTIONS) REQUIRES 1 1/2 FLEX STRIPS.

| QTY | QTY REQD | FROM NO. | PART OR IDENTIFYING NO. | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION |
|---|---|---|---|---|---|
| 1.5 | 1.5 | | D8 | FLEX STRIP 3" LONG 12 CONNECTIONS (F/S) | 15-31-003 |
| 1 | 1 | | R86 | RESISTOR 150 Ω 1/4W | 18-02-067 |
| 1 | 1 | | R85 | RESISTOR 330 Ω 1/4W | 18-02-422 |
| 1 | 1 | | R84 | RESISTOR 470K Ω 1/4W | 18-02-465 |
| 1 | 1 | | R83 | RESISTOR 1MEG Ω 1/4W | 18-02-469 |
| 1 | 1 | | R82 | POTENTIOMETER 10K Ω | 19-05-015A |
| 1 | 1 | | R81 | RESISTOR 2.2K Ω 1/4W | 18-02-441 |
| 5 | 5 | — | R75 THRU R79 | RESISTOR 470 Ω 1/4W | 18-02-435 |

PARTS LIST

TELEDYNE HASTINGS-RAYDIST
HAMPTON VIRGINIA U.S.A.

| | | | | |
|---|---|---|---|---|
| DRAWN P.M.M. 4/03/86 | SIZE B | FSCM NO. — | DWG. NO. 30378 | REV. D |
| ISSUED | SCALE NONE | | SHEET 2 | |


FROM MAIN BOARD PC-750, 30376
DB12
DB11
DB8
DB7
DB3
DB9
DB10
DB6
DB2
+5V
R66
R67
C49
IC22
IC23
IC24
IC21
IC25
R57
C41
IC26
D13
D14
D8
D9
D10
R75
R76
R77
HI SET
LO SET
OPER
LO ALARM
HI ALARM
C80
D84
+2.5V
R81
R82
R83
C44
C45
C46
C47
C48
R84
D85
-5.0V
D81
R86
R85
SCHEMATIC DIAGRAM
FOR DNNV-46J DISPLAY BOARD
PC-751A
TELEDYNE HASTINGS-RAYDIST
DRAWN MHG & PM 4/14/88
ISSUED
SIZE B
FSCM NO.
DWG NO 30378
REV D
SCALE NONE
SHEET 3 of 3

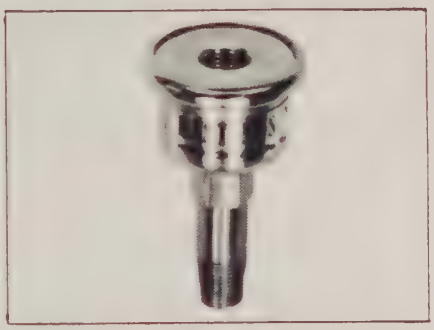
TELEDYNE
HASTINGS-RAYDIST

Specification Sheet No. 352A

TELEDYNE HASTINGS RAYDIST
P.O. BOX 1275
HAMPTON, VIRGINIA 23661 U.S.A.
TELEPHONE [illegible]
FAX (804) 723-3925
EASYLINK [illegible]

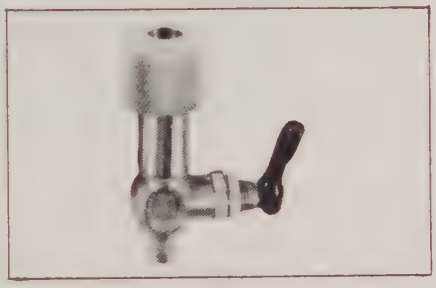
# Hastings Installation Accessories for Vacuum Gauge Tubes

## SAVE TIME - TROUBLE - TUBES



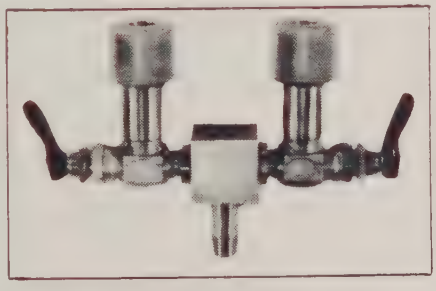
### DROP-OUT TRAP Type DO-1

A particle drop-out trap which also provides an effective optical baffle. It has the equivalent of eight 90 degree bends. Protects gauge tube from flying particles, evaporated metals, etc. The gauge tube threads into the trap which installs in existing gauge tube fitting. Simple piggy-back installation. "Monel"/nickel plated brass constructed. Clean with steam, solvents, air hose, ultrasonics, etc. 1/8" NPT fittings; female for gauge tube, male to system.



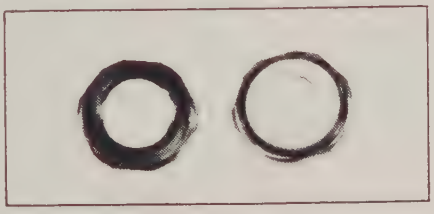
### VALVED QUICK CONNECT Type OS-V & OS-VR

Provides a quick-connect "O" ring seal fitting for the gauge tube with toggle type shut-off valve. Permits removal and replacement of a gauge tube in many systems without "breaking" the entire system to atmospheric pressure. Also permits closing off tube during "dirty" portion of cycle. Installs in 1/8" NPT female thread. Type OS-VR is right angle pattern valve. Size: 1" x 3" x 3 1/2" Brass construction.



### DUAL VALVED QUICK CONNECT Type OS-V2

Similar to above except permits use of an additional tube in a second pressure range, or as a calibration check against production tube. Keeps an unused spare ready to go. Installs in 1/8" female threaded fitting of existing gauge tube. Adjustable for angled or straight installation. Brass construction. 7 1/2" x 1" x 3 3/4".



### HASTINGS SEAL-NUT Type OS-H

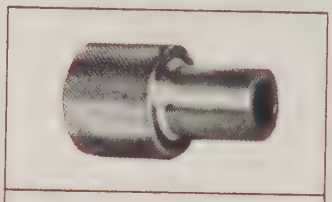
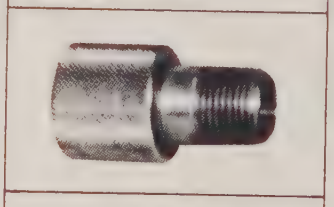
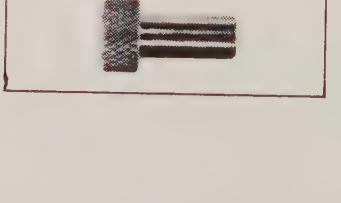
A metal hex nut with "Teflon" insert. Threads over 1/8" NPT male thread and jams against fitting to provide a dry, non-shredding reusable vacuum tight seal. Eliminates messy liquid sealants. Use to install gauge tubes, quick connects, drop-out trap and other 1/8" NPT male fittings in vacuum systems. Supplied in packages of 10, 25, 50 and 100.

# HASTINGS QUICK CONNECTS

H-R Quick Connects offer an "O" ring sealed fitting for Hastings and other gauge tubes with 1/8" pipe stems (.405" OD tubing). They provide a clean dry leak-tight seal and permit quick, easy removal and replacement of gauge tubes without wrenches or messy sealants.

Easiest conversion is with OS-F Quick Connect, which threads into existing gauge tube 1/8" NPT fitting on the system. Solder thread for permanent seal, or use H-R Seal Nuts.

RECOMMENDED PROCEDURE: Install all fittings so gauge tube opening points down, so as to be self-draining.

| CONNECTION<br>Gauge Tube Side<br>Install Up | QUICK CONNECT | TYPE NO. | CONNECTION<br>System Side<br>Install Down |
|---|---|---|---|
| Fits Gauge Tube Stem "O" ring seal (QC Side) |  | OS-A | 5/8" OD, .410 ID, solder or braze to system, tee, etc. |
| Fits Gauge Tube Stem "O" ring seal (QC Side) |  | OS-B | 3/8" NPT male thread |
| Fits Gauge Tube male thread. (1/8" NPT female thread) | | OS-C | Fits 8 mm and 5/16" OD smooth tubing, metal gauge to glass system, etc. (QC side) |
| Fits Gauge Tube Stem "O" ring seal (QC Side) | | OS-F | 1/8" NPT male thread fits 1/8" NPT female thread where tube is removed. |
| .405" dia. blank plug with shoulder. (Same dia. as gauge tube stem) |  | OS-G | Install in quick connect to close system when gauge tube is removed. Supplied in package of 5. |

TELEDYNE
HASTINGS-RAYDIST

HAMPTON, VIRGINIA 23661, U.S.A.
PRINTED IN U.S.A.
SPECIFICATION SHEET #352A

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HASTINGS-RAYDIST

TELEDYNE HASTINGS-RAYDIST
P.O. BOX 1275
HAMPTON, VIRGINIA 23661 U.S.A.
TELEPHONE (804) 723-6531

FAX (804) 723-3927
EASYLINK 62300287
TWX 710-882-0085
TDYHAST HAMP

Specification Sheet No. 353B

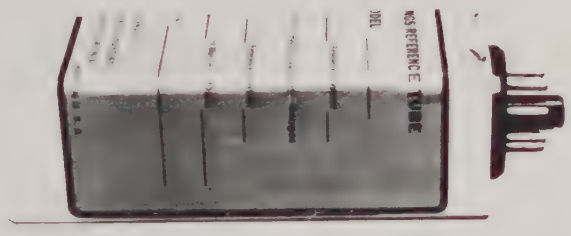
# HASTINGS •

# REFERENCE TUBE

## A QUICK CALIBRATION DEVICE FOR HASTINGS VACUUM GAUGES

### General:

The Hastings Reference Tube is an evacuated, sealed vacuum gauge tube accurately calibrated and marked at its exact pressure. It is electrically equivalent to the metal and Pyrex gauge tubes used with Hastings Instruments. It permits quick and easy recalibration of Hastings Vacuum Gauge Indicators by merely plugging the instrument into the reference and adjusting the calibration "current set" potentiometer until the instrument reads the exact pressure noted on the reference. Hastings Reference Tubes are available equivalent to each Hastings Gauge Tube.



- **Instant Calibration Check**
- **Recalibration of Hastings Gauges**
- **Adjusts Gauge for Any Length Cable**

**STABLE, ACCURATE, RUGGED, RELIABLE**

### Construction:

Hastings Reference Tubes employ the same patented Hastings noble metal thermopile used in all Hastings Vacuum Gauge Tubes. The thermopile is sealed in a Pyrex glass capsule which has been evacuated, baked, outgassed, sealed and then aged to insure stability over long periods of time. The sealed capsule is then housed in a protective metal shell to provide a rugged, trouble-free assembly.

### Calibration:

Considerable care and time are required in the manufacture to obtain the high degree of precision and stability required for the reference tube.

The thermopile is matched to the reference letter of the customer's tubes and maintains its calibration over long periods of time. However, for applications requiring the highest possible degree of accuracy a periodic return of the Reference Tube to the factory for a check and recalibration may be desirable. An annual or semiannual check assures the customer of an accurate and reliable reference at all times.

### Application:

Hastings Vacuum Gauge Indicators, Controllers or Recorders can be checked or recalibrated in seconds by merely plugging the gauge tube cable into the reference tube. If calibration adjustment is necessary the "Current Set" potentiometer is adjusted until the instrument indicates the exact pressure marked on the reference tube. The customer now knows his instrument is correctly calibrated.

Whenever cable lengths between gauge tube and instrument are changed some error may be introduced, requiring that the instrument be readjusted to compensate for any losses involved. By plugging the Reference Tube into the new cable and readjusting the instrument for a correct reading, this "error" is eliminated.

Manufactured under one or more U. S. Patents

# REFERENCE TUBE

**Selection:**

Choose the reference tube which is equivalent to the Pyrex or metal Hastings Gauge Tube you are now using. The Reference Tube will be matched and sealed at a pressure falling on the lower portion of the scale and calibrated accurately at this exact pressure. For example, if an instrument uses a DV-3M Gauge Tube a DB-17 Reference Tube is ordered. The customer receives a tube marked, possibly, 10 microns. This is the exact pressure to which the indicator should be adjusted when plugged into the reference tube.

## SELECTION CHART

| Equivalent Gauge Tube and Range | | | Reference Tube |
|---|---|---|---|
| Metal | Pyrex | Range | Model No. |
| *DV-3M | *DV-17 | 0-1000 Microns Hg | *DB-17 |
| *DV-4AM | *DV-16 | 0-20 mm Hg | *DB-16 |
| DV-4D | DV-16D | 0-20 mm Hg | DB-16D |
| *DV-5M | *DV-18 | 0-100 Microns Hg | *DB-18 |
| DV-6M | DV-20 | 0-1000 Microns Hg | DB-20 |
| DV-8M | DV-31 | .01-10 Microns Hg | DB-31 |
| DV-23 | | 0-5000 Microns Hg | DB-33 |
| DV-24 | | 0-50 Torr | DB-44 |
| DV-100 | | 0-100 Torr | Not Available |
| *State reference letter of your Gauge Tube type for matching purposes. | | | |

**IMPORTANT NOTE:** These Reference Tubes are designed specifically for use with instruments employing Hastings circuitry and are NOT interchangeable with instruments using other circuitry. Connection to another manufacturer's instrument may result in burnout.

**Teledyne Hastings-Raydist manufactures a complete line of over 100 models of Recorders, Gauges and Controllers. Write for Catalog.**

TELEDYNE HASTINGS-RAYDIST

HAMPTON, VIRGINIA 23661, U.S.A.
PRINTED IN U.S.A.
SPECIFICATION SHEET #353B

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TWX: 710-882-0085
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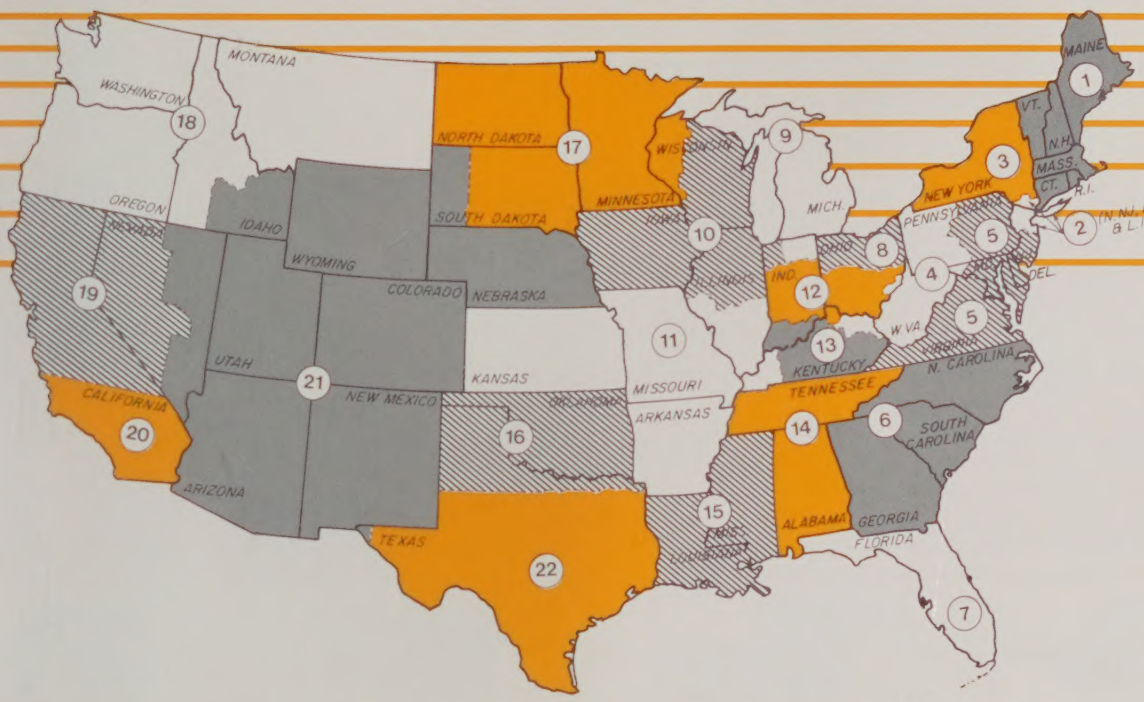
TELEDYNE HASTINGS-RAYDIST

# Sales Representatives

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(201) 785-4450

**(3) GEORGE O. MILLER CO.**
5858 E. Molloy Road
Syracuse, NY 13211
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**(4) FOGLEMAN CO., INC.**
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Pittsburgh, PA 15234
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**(5) TYLER GRIFFIN CO.**
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Outside GA 1-800-622-9555

**(7) HARRA TECHNICAL SALES**
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(502) 589-2041

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(3) **BANGLADESH**
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(4) **BELGIUM AND LUXEMBURG**
Regulation-Mesure, S.P.R.L.
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(5) **BRAZIL**
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(6) **CANADA**
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Brian Controls Division
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Montreal, Quebec, Canada
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(7) **ENGLAND**
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(Flow & Air Velocity)
Tudor House, Grammar School Road
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(7) **ENGLAND**
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(9) **FRANCE**
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(12) **HOLLAND (NETHERLANDS)**
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(13) **INDIA**
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(14) **ISRAEL**
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(15) **JAPAN**
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(16) **KOREA**
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(17) **MEXICO**
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(18) **NEW ZEALAND**
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(19) **NORWAY**
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(20) **PHILIPPINES**
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(21) **PUERTO RICO, US VIRGIN ISLAND, DOMINICAN REPUBLIC AND HAITI**
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(22) **SOUTH AFRICA**
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(23) **SPAIN**
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(24) **SWEDEN**
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(25) **SWITZERLAND AND AUSTRIA**
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(26) **TAIWAN**
Match-Good Enterprises Co., Ltd.
P.O. Box 81-841
Manila-Taiwan Development Bldg.
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Taipei, Taiwan R.O.C.
Telephone: (02) 7155898

**TELEDYNE HASTINGS-RAYDIST**

**TELEDYNE HASTINGS-RAYDIST**
**P.O. BOX 1275**
**HAMPTON, VA 23661 U.S.A.**
**TELEPHONE (804) 723-6531**

**TWX: 710-882-0085**
**ANSWERBACK: TDYHAST HAMP**
**FAX: (804) 723-3925**
**EASYLINK: 62-300280**
**C-177N, ©12-88**

## WARRANTY

Teledyne Hastings-Raydist warrants this product for a period of one year from date of shipment to be free from defects in material and workmanship, and to perform to published specifications.

This warranty does not apply to defects or failures resulting from unauthorized modification, misuse, or mishandling of the product. This warranty also does not apply to fuses, filters, batteries, or other expendable parts, nor to damage caused by leaking batteries, clogged filters, or similar occurrences.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty as to fitness for a particular use. Teledyne Hastings-Raydist shall not be liable for any indirect or consequential damages.

## WARRANTY REPAIR POLICY

Teledyne Hastings-Raydist will repair or replace, at their option, any product covered under the above warranty that is returned transportation prepaid to their plant in Hampton, VA. All products returned must be accompanied by the Service Request information form in the manual or a written description of the problem. Please contact factory for a Repair Authorization Number before returning any product for repair.

## NON-WARRANTY REPAIR POLICY

Any product returned for non-warranty repair must be accompanied with a purchase order authorizing repair up to 1/3 the list cost of a new product or $50, whichever is greater, and the Service Request information form in the manual or a written description of the problem. If the repair cost is higher, you will be contacted for authorization before we proceed. If you then choose not to have the product repaired, the $50 minimum will be charged to cover processing and inspection. Please contact factory for a Repair Authorization Number before returning any product for repair.

**Teledyne Hastings-Raydist**
**804 Newcombe Avenue**
**Hampton, VA 23669**

**Telephone (804) 723-6531**
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